





S. H. D. W.





Rathbun, P



Morgan Expedition, 1870.

CHAS. FRED. HARTT, IN CHARGE.

PRELIMINARY REPORT

ON THE

CRETACEOUS LAMELLIBRANCHS

COLLECTED IN THE VICINITY OF
PERNAMBUCO, BRAZIL.

BY RICHARD RATHBUN.

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With the respects of the author.

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PRELIMINARY REPORT ON THE CRETACEOUS LAMELLIBRANCHS
COLLECTED IN THE VICINITY OF PERNAMBUCO, BRAZIL, ON
THE MORGAN EXPEDITION OF 1870, CH. FRED. HARTT IN
CHARGE. BY RICHARD RATHBUN, ASSISTANT IN THE MUSEUM
OF THE BOSTON SOC. OF NAT. HISTORY.

After partially completing his explorations on the lower Amazonas during the Morgan Expedition of 1870,¹ Prof. Hartt directed two members of his party, Messrs. O. A. Derby and D. B. Wilmot, to explore various portions of the coast, between the mouth of the Amazonas and the city of Pernambuco. In the neighborhood of the latter place were found several outcrops of fossiliferous rocks, which have since proved to be of cretaceous age. Quite extensive collections of the contained fossils were made and sent to this country, and last year the mollusca were offered me for study.

The localities from which the specimens were obtained are three exposures, situated at and near the mouth of the Rio Maria Farinha, and all included within a radius of two or three miles. The Rio Maria Farinha is but a small stream, which, in the latter part of its course, flows nearly due east, and enters the ocean at a point about eighteen miles north of Pernambuco, and a few miles south of the island of Itamaracá, lying just off the coast. On the north side of the river, at its mouth, is an elevated point called Nova Cruz, which rises in a cliff about twenty-five feet in height and is composed mostly of beds of colored clays. In the upper part of this cliff appears a single layer, about three feet in thickness, of a grayish, fossiliferous limestone, with clay immediately above and below it. The entire cliff is

¹ For a brief account of this Expedition, see "Preliminary Report of the Morgan Expeditions, 1870-71," by Ch. Fred. Hartt. Bulletin of the Cornell University, (Science), Vol. I, No. 1, 1874.

capped with a bed of unconsolidated tertiary sand, and both the clays and the limestone composing it are probably of cretaceous age.

Following up the river along the north side for about a mile, we come upon a rather heavy bed of hard, whitish limestone, outcropping from the plain near the bank of the river, and containing cretaceous fossils, mostly lamellibranchs. It is covered with tertiary deposits. This stone is extensively burned for lime and may be designated the Maria Farinha bed. On the south side of the river, about midway between its mouth and Maria Farinha, and a short distance from its bank, is a slight exposure of fossiliferous cretaceous limestone, resembling the limestone bed in the cliff at Pt. Nova Cruz. Only the upper portion of a single layer projects from the tertiary plain. To this bed has been given the name São José.

As far as could be ascertained, the beds at São José and Pt. Nova Cruz are horizontal, while the Maria Farinha bed has a slight dip to the west, only observable in large exposures of the rock; but the relative horizon of the beds of the three exposures could not be determined, as the surface is everywhere covered with loose materials.

A careful comparison of the fossils obtained from them has shown, however, that although none of the species, so far as known, occur in all three beds, yet some are common to both the Pt. Nova Cruz and São José localities, while others are found in the Maria Farinha and either the São José or Pt. Nova Cruz beds. The character of the rock in the three exposures is also quite similar, all uniting to prove the close relationship of the beds, which may belong near the Sergipan and Cotinguiban groups of Prof. Hartt. The beds at Pt. Nova Cruz and São José seem to be more nearly related to one another, than do either of these to the one at Maria Farinha. The limestone containing the fossils is somewhat porous, and, being constantly exposed to the weather, the shells have been entirely removed by the percolation of water, thus leaving only the moulds of the exterior and interior, some of which are very perfect.

Lamellibranchs are by far the most abundant fossils in all three localities. At Point Nova Cruz and São José, gasteropods and cephalopods are quite common, the latter often of considerable size, but in a poor state of preservation. Some few fish and crustacean remains, together with a single echinoid and fragments of a small coral, were also found. On the island of Itamaracá, three or four miles above the mouth of the Rio Maria Farinha, there is exposed a bed of soft

drab-colored limestone, containing fish remains and a few obscure moulds of lamellibranchs.

As I have not as yet had time to finish the study of all the mollusca collected on the Rio Maria Farinha, descriptions of only the larger and more prominent forms among the lamellibranchs have been given in this paper. In a future and more complete report I hope to furnish figures of all the forms here described.

Though disliking to increase the already large number of names among the cretaceous mollusca, I have found it necessary to designate and name as new all but two of the forms herein described. They have been carefully compared with the collections in the Museum of Comparative Zoology at Cambridge, with those of the Boston Society of Natural History, and also with the literature on the subject contained in the libraries of both the above-named institutions.

I am greatly indebted to Mr. Alex. Agassiz, for kindly allowing me free use of the collection of Palaeontology and the library in the Museum at Cambridge; and also to Count L. F. de Pourtalés and Mr. O. H. St. John of Cambridge, who aided me much in my comparisons. To Prof. A. Hyatt, of the Boston Soc. of Nat. History, I am under many obligations for aid and advice in the preparation of this short paper. It is due Mr. O. A. Derby of Cornell University, to whom the first right of the collection belonged, to state here, that he had already done some work upon it before I received it. He had carefully prepared most of the specimens and separated many of the species. The account of the localities is, of course, taken entirely from his notes.

Family OSTREIDÆ.

Gryphæa (sp.?)

There are numerous internal moulds of a small oyster, belonging to this genus, but no external moulds perfect enough to show the true specific characters of the form were obtained. The thickening within the beak varies greatly, sometimes almost entirely filling up that portion of the shell. The exterior surface seems to have been marked simply with small, irregular, concentric lines. From the cretaceous bed at São José, Prov. of Pernambuco, Brazil.

Exogyra lateralis (Nilsson).

Ostrea lateralis Nils., 1827. *Petrif. succana.*

?? *Chama canaliculata* Sow. 1813. *Min. conch.*

There were obtained from the limestone beds at São José and Pt. Nova Cruz two specimens of *Exogyra*, which, with very little doubt,

belong to the above species and increase its already extended range. *Exogyra lateralis* is found in Europe in the Grès Vert du Mans, Etage supérieur, and in the Greensand of Essen on the Ruhr. It also occurs in the Greensand of New Jersey in the United States. Its occurrence in eastern Brazil will give it a distribution not attained by many of the cretaceous mollusca.

A comparison of the Pernambuco forms with many specimens of the same species, both from Europe and the United States, gives the following results. The Pernambuco specimens are of the medium size attained by *E. lateralis*. In outline and general shape they agree very closely with some of the European and N. American specimens, but the latter vary much among themselves. The lower valve is smooth on the exterior. The upper valve is slightly convex, and ornamented by conspicuous, overlapping, concentric layers of growth, which agree perfectly with the same features in the N. American and European forms.

But two specimens were found, both moulds of the shell, showing the exterior and interior, one of both valves, the other of only the upper valve.

From São José and Pt. Nova Cruz, Prov. of Pernambuco, Brazil.

Some little confusion exists as to the synonymy of this species. In 1813 Sowerby described a species of cretaceous oyster as *Chama canaliculata*. This, with *Ostrea lateralis*, described and named by Nilsson in 1827, are considered one and the same by D'Orbigny in his *Paléontologie Française*, published in 1843, and the name of course changes to *Ostrea canaliculata* of D'Orb. Still later some writers, I do not know whether by direct observation or not, have given the two as distinct. In the collections to which I have had access, the specimens, with which I have identified the Brazilian form, have been determined and labeled by good European authorities as *Exogyra lateralis*. I have not seen *Exogyra (Chama) canaliculata*.

Family NUCULIDÆ.

Nucula Mariæ sp. nov.

Shell minute, slightly elongate, and with the valves moderately convex. In the internal mould the outline is obliquely subovate, the beaks are placed far forward, less than one-fourth the length of the shell from the anterior margin, are prominent, elevated slightly above the

hinge and incline strongly forward. The hinge equals a little more than one-half the length of the shell, and descends quite rapidly from the beaks toward the posterior margin, where it ends abruptly. The latter, which has about the same height as the anterior margin, begins, in the internal moulds, at a higher level than the posterior extremity of the hinge, since at this point, as is generally the case in *Nucula*, the cavity of the shell extends nearer to the true margin than it does along the hinge. It rounds strongly to the ventral margin. The anterior margin curves quite rapidly downward and backward, but is not so fully rounded as is the posterior margin.

The valves are most convex in the lower part of the umbonal region, and curve moderately from the beaks to the ventral margin. The curvature of the surface from the anterior to the posterior margin is also very moderate and quite regular, though the valves are slightly flattened in the middle. By the thickening of the margins of the shell, where they approached one another, there has been formed a slightly flattened or concave area or band on the mould, bordering its margins, which are very acute.

Only a single specimen was obtained, the interior moulds of the two valves attached. In breaking this from the rock, the exterior mould was injured beyond repair, but enough remains to show that the surface of the shell was smooth, or marked only with indistinct concentric lines. Size: length, 3.25 mm.; height, 2.5 mm.; depth of two valves, 1.5 mm.

In its interior characters this form approaches very closely some of the varieties of *Nucula pectinata* Sow. of the European cretaceous, but the latter form is a very much larger one and the surface of the shell is marked with prominent radiating lines.

From the cretaceous limestone bed at Maria Farinha, Prov. of Pernambuco, Brazil.

Family LEDIDÆ.

Leda Swiftiana sp. nov.

Shell very small, elongate and moderately gibbous. It is elongate-ovate in outline, with the length more than one and one-half times the height. The beaks are very large, prominent and quite strongly incurved; they are situated a little in advance of the middle of the shell. Posterior to the beaks, the hinge descends quite rapidly to the posterior margin and forms a slight outward curve. The anterior

portion of the shell is a little higher than the posterior and is well rounded. The posterior margin rounds rather abruptly, and the anterior more gradually, downward from the hinge toward the ventral margin, which last is moderately curved. The shell is slightly angular posteriorly, where the line of the hinge bends rapidly downward, at a point a little above the median line.

The surface arches quite strongly from the beaks to the ventral margin. The curvature of the surface from the anterior margin to the posterior is more moderate and quite regular. Hinge teeth minute and numerous. The surface is marked by very numerous, regular, fine, thread-like concentric lines, which are very prominent and are separated by slightly narrower interspaces. On one specimen there were about 25 or more of these lines. Length of shell, 8 mm.; height, 5 mm.; depth of each valve, 2 mm. The shell from which these measurements were taken is somewhat above the ordinary size. This form is distinguished from *Leda braziliensis*, the next one to be described, by its greater proportionate height and convexity.

From the cretaceous beds at Maria Farinha and Pt. Nova Cruz, Prov. of Pernambuco, Brazil, where it is moderately abundant. Dedicated, at Mr. Derby's request, to Mr. H. H. Swift, formerly U. S. Consul at Pernambuco, as a grateful acknowledgement of many favors received from him during the trip.

***Leda braziliensis* sp. nov.**

Shell very small, moderately convex and elongate, with the length a little greater than twice the height. Beaks slightly anterior to the middle. The hinge, posterior to the beaks, forms a slight inward curve and descends gradually in extending backward. The margin posteriorly forms an acute angle with the hinge, or the shell may have been slightly rounded at this point. The ventral margin forms a long, very moderate curve, which is somewhat stronger anteriorly. The anterior extremity of the shell is higher than the posterior, and is well rounded. The hinge margin in front of the beaks is nearly straight, or has a slight outward curvature.

The convexity of the valves is moderate and greatest near the middle. The curve across the valves increases very slightly in strength from the ventral margin toward the beaks, which are minute and pointed. No external moulds have been found. The teeth are very small and numerous. Size: length, 7.5 mm.; height, 3 mm.

This form of *Leda* has a shape quite common among the species of that genus; yet it seems to differ enough from all the species with

which I have been able to compare it to merit description. It is readily distinguished from *Leda Swiftiana*, above described, by its more elongate form, less prominent valves, and by the posterior portion of the hinge descending less rapidly.

From the cretaceous bed at São José, Prov. of Pernambuco, Brazil. A few specimens only have been obtained.

Family ARCIDÆ.

Arca Orestis sp. nov.

Shell of moderate size, elongate, somewhat compressed, and with the vertical axis nearly two-thirds the antero-posterior. In outline it is subelliptical, the height being greatest near the middle, but not varying much throughout the length of the shell. Beaks prominent, rounded, not incurving or inclining forward very strongly. Their distance from the anterior margin is much greater than one-third the length of the shell.

The hinge is equal to two-thirds the length of the shell or slightly more. The anterior extremity is not so high as the posterior and is regularly rounded, the curve of the anterior margin continuing regularly into that of the ventral. The latter is slightly rounded and descends gradually in extending backward. The posterior margin is slightly oblique and rounded.

The valves are most prominent in the umboinal region, but become flattened in the lower two-thirds. The surface rounds gradually into the posterior slope, which forms a slight sigmoidal curve in descending toward the hinge. In no part is the shell angular.

The markings of the shell consist of small, rounded, or slightly angular, radiating raised lines or plications, separated by narrower, sub-angular interspaces. The lines curve slightly in extending from the beak to the margin. On the posterior slope they are very fine and thread-like. The concentric lines are very small and numerous.

Length of shell, 32 mm.; height, 21 mm.; depth, of each valve, 6 mm.

Only a single specimen, a left valve, was obtained and that is much exfoliated, more especially near the beak. The internal characters are not exposed. This form is readily distinguished by the slight prominence of its valves, and by the surface being everywhere without abrupt curves. The markings are also quite simple.

From the cretaceous bed at Maria Farinha, Prov. of Pernambuco,

Brazil. Respectfully dedicated to Mr. Orestes H. St. John, lately of the Museum of Comparative Zoology at Cambridge, Mass.

Area (Cucullea?) Harttii sp. nov.

Shell of medium size, elongate, gibbous, with the height nearly two-thirds the length. Outline of internal mould subovate, the height of the posterior extremity being much greater than that of the anterior. The beaks are situated at a little more than one-third the length from the anterior margin, are very prominent and incline strongly forward. Hinge nearly as long as the shell. The posterior margin extends obliquely downward and slightly backward, rounding strongly toward the ventral margin. The anterior margin leaves the hinge abruptly, at nearly a right angle, and curves rapidly round to the ventral margin, which is slightly rounded and descends moderately in extending backward.

The valves are very convex and arch strongly from the beaks to the ventral margin. The depth of each valve is more than one-third the height of the shell. The posterior slope commences abruptly along a line extending from just behind the beaks to the lower posterior corner, and descends rapidly to the hinge and posterior margin. This slope is broad, quite concave just back of the beaks, but becomes nearly straight posteriorly.

The surface is marked by small, rounded or subangular, radiating raised lines, which are very fine at the beaks, where they are of about the same width as the interspaces, or narrower, and increase very gradually in size toward the margin, the interspaces there being much the narrower, and even reduced to mere striae. Fine concentric lines cross the shell; on the upper portion of the shell they are very regular, but near the ventral margin they become more numerous and are crowded together. As they cross the radiating lines they become very prominent, sometimes giving to the latter a beaded appearance. On the posterior slope the radiating lines are minute, thread-like and near together, being separated by very narrow depressions. These seem to be made even more beaded in appearance by the concentric lines than are the radiating lines on the main portion of the shell, though they are exceedingly fine. The inner margin of the shell is crenulated.

This shell is quite a thick one, and none of the exterior characters appear in the interior, so that the angular appearance presented by the external moulds is not apparent in the very numerous internal ones. The characters of the interior are quite obscure in all the

specimens obtained, rendering the determination of the genus a little doubtful. The posterior end of the hinge seems to be marked with the longitudinal teeth peculiar to *Cucullea*, while in the interior moulds there is a slight, rounded depression, bordering the posterior muscular imprint below, and extending some distance toward the beak. As to shape the form is truly *Cucullean*. Size of a medium specimens: length, 27 mm.; height, 18 mm.; depth of both valves, 16 mm.

Very abundant, as interior moulds, in the whitish limestone of the Cretaceous at Maria Farinha, Prov. of Pernambuco, Brazil. Dedicated to my teacher and friend, Prof. Ch. Fred. Hartt.

Cucullea subcentralis sp. nov.

Shell small, elongate, very gibbous, subrhomboidal in outline, and about two-thirds to three-fourths as high as long. The anterior and posterior margins are of nearly the same height, the latter being a little the higher. The posterior margin is slightly oblique and rounded, and curves abruptly to the ventral margin. The anterior rounds gradually into the ventral, which curves but slightly, being a little straightened along the middle, and is subparallel with the hinge. The latter nearly equals the length of the shell, and joins the anterior and posterior margins abruptly.

The surface of the shell arches strongly from the beaks to the ventral margin. Beaks situated just anterior to the middle; from them an undefined prominence or carina generally extends obliquely across the interior mould of the shell to the lower posterior angle. This marks the beginning of the posterior slope which is very abrupt. A shallow rounded depression runs parallel to the prominence, and above it, on the posterior slope; but these features are not always apparent. The valves are most convex in the upper part, in the umbonal region and along the carina, and the whole upper part of the shell is usually very much inflated.

In the interior moulds the beak is quite pointed and incurves about half way to the hinge, above which it is moderately elevated. Its inclination forward is not very strong. A shallow, rounded depression, very narrow where it begins, but broadening out and shallowing as it advances, extends a little obliquely backward from the apex of the beak toward the ventral margin. Near the margin it has disappeared. In the various specimens it is differently developed, sometimes extending but a little way from the beak. This must indicate a corresponding prominence in the interior of the valves. The

curved slope in the moulds, between the beak and the hinge, is very broad. Inner margin of the valves crenulated. A specimen of medium size measures: length, 18 mm.; height, 12 mm.; depth of each valve, 6 mm.

This form is readily distinguished from all the others at Maria Farinha by the nearly central beaks. It is moderately abundant, but only internal moulds have so far been obtained; the exact exterior characters are thus unknown. A single, very small specimen, which I have referred to this species as the young, shows the impressions of nearly all the teeth on the hinge, and the extreme ones are longitudinal. The muscular imprints are very indistinct.

From the Cretaceous limestone bed at Maria Farinha, Prov. of Pernambuco, Brazil, associated with *Cucullea Harttii*, which it somewhat resembles.

Family ASTARTIDÆ.

Cardita Morganiana sp. nov.

Shell above the medium size and ventricose, with the length nearly equal to, or slightly exceeding, the height, and the depth of the two valves about three-fourths the length of the shell. The outline of the internal moulds varies from subovate-orbicular, when of medium size, to subtrigonal at an older age. Length of hinge line somewhat greater than one-half the length of the valves.

In the larger specimens the posterior margin is very oblique and nearly straight for about half its length from the hinge; then it rounds rapidly and regularly to the ventral margin, which curves but moderately. The anterior margin is shorter than the posterior and is quite regularly rounded. The posterior margins of the umbones, together with the upper and larger part of the posterior margin of the shell, lie in nearly the same straight line, as do also the anterior margins of the umbones and a small part of the anterior margin of the shell, the two lines so indicated forming a slightly acute angle at the beaks; while the slightly curving ventral margin completes a rather imperfect triangle. This character of outline is observable in the larger and more perfect internal moulds only; in the smaller specimens the outline is frequently nearly circular; but the various forms so graduate into one another as to make their identification easy.

The valves are very convex and swell out rapidly from the margins. They are most prominent just above the middle, or in the

lower part of the umbonal region. Beaks large, acute, very prominent and much elevated above the level of the hinge. Their inclination forward is strong, as is also their inward curvature; but they do not approach one another very closely in the internal moulds. Along the antero-posterior axis the valves curve rapidly upward from the posterior margin, and descend quite abruptly to the anterior. The internal moulds of the valves have frequently a very oblique appearance, caused by the more convex portions tending to form a large and prominent, but wholly undefined, ridge, which extends downward and slightly backward from the beaks, and broadens and dies out toward the margin.

As only internal moulds have been obtained, the exterior markings and other exterior details are yet unknown. The inner margin is marked with about sixteen large and prominent, rounded or flattened crenulations, separated by similar interspaces; but the plications of the shell are seldom apparent on the interior. The hinge teeth are not fully exposed on any of the specimens. The anterior and posterior adductor muscular impressions are sometimes rather deeply excavated; they are generally situated nearly on the antero-posterior axis, but the posterior one is at times placed slightly lower than the anterior. Their longer axis is nearly vertical or inclines slightly forward. The imprint of the anterior pedal muscle is very small and entirely separated from the adductor. The size of a large specimen is: length, 42 mm.; height, 39 mm.; depth of the two valves, 31 mm.

This is a rather large form of *Cardita*, and is represented by several internal moulds both from the cretaceous bed at São José and that at Maria Farinha, Prov. of Pernambuco, Brazil. I take pleasure in dedicating this large and fine form to Col. Edwin B. Morgan of Aurora, N. Y., who has so kindly and liberally aided in Brazilian Exploration.

***Cardita Wilmotii* sp. nov.**

Shell of medium size, moderately gibbous, length and height nearly equal, depth of the two valves about one-half to two-thirds the height. In outline it is subcircular; the anterior, posterior and ventral margins together form quite a regular curve, which is, however, slightly more abrupt near where the posterior and ventral margins meet; this curve, if prolonged above to the beaks, would make nearly a perfect circle. The hinge is short and equal to about one-half the length of the shell. Beaks situated at a little more than

one-third the length of the shell from the anterior extremity, and in the interior moulds, in which state alone they have been obtained, they are acute at the apex and curve strongly inward and moderately forward. They closely approach one another.

The valves are most prominent just above the middle, and arch strongly from the beaks to the ventral margin. The curvature along the antero-posterior axis is strong and generally regular; sometimes the slope is more abrupt posteriorly.

The surface is ornamented with prominent narrow plications, separated by broad interspaces. The plications are very fine and high at the beaks, and gradually increase in size toward the margins. The interspaces are profound, flattened or slightly rounded in the bottom, and two to three times as wide as the plications. At the base of each plication, on either side, runs a fine thread-like line, which seems to begin near the beak and extends to the margin, increasing slightly in size. Very fine and numerous concentric lines cross the valves, and on the plications are grouped together so as to form regular bead-like prominences. On worn specimens the separate character of the beads is lost, and the plications appear rounded and thread-like on the summit. In the interior of the valves the plications are very apparent, and they have left their imprint upon the internal moulds, as low rounded plications and interspaces of about equal width, which die out near the beak.

The inner margin of the valves is crenulated, while just within the margin there is sometimes a smooth band or area of varying width. The anterior adductor muscular impression is small and slightly excavated. The imprint of the very small pedal muscle, lying above the anterior adductor, is entirely separated from it.

The general characters of this form are those of *Cardita*, and the hinge characters, so far as they are preserved or exposed, seem also to agree with those of that genus. There is an elongate posterior lateral tooth, and above this a fine linear prominence. The plications in the genus *Cardita* do not generally show as prominently in the interior of the shell as happens in this form. A specimen of good size measured: length, about 23 mm.; height, 23 mm.; and depth of both valves, 17 mm.; but the shell is usually more flattened than in this case.

Abundant in the cretaceous limestone bed at São José, Prov. of Pernambuco, Brazil.

Family LUCINIDÆ.

***Lucina tenella* sp. nov.**

Shell very small and lenticular, with the length slightly greater than the height. Valves moderately convex.

The beaks are small, not at all prominent, are situated near the middle of the shell and incline slightly forward. The margins of the valves, so far as can be determined from their imperfect condition, form nearly a circle, truncated slightly at the hinge. Anteriorly the shell is produced a little upward, nearly as high as the beak, the hinge margin forming in front of the beaks a slight inward curve, and then ascending a little to the upper anterior angle. The hinge, posterior to the beaks, is apparently straight and descends moderately toward the posterior extremity.

Valves most convex just above the middle. The surface curves moderately from the beaks to the ventral margin, the curvature decreasing gradually in strength downward. Along the antero-posterior diameter the curvature is gradual and regular. The upper posterior portion of the shell becomes suddenly slightly compressed from along a line extending from behind the beaks to a short distance below the middle of the posterior margin. This compressed portion forms a rather narrow crescentic space, bordering the margin.

The surface is marked with very fine, regular, slightly overlapping, concentric raised lines of growth, those near the beaks being often quite faint; but they become gradually coarser toward the margin. On the posterior depressed space they are deflected slightly upward. The interspaces are very much broader than the lines and are flattened, and all of about equal width. The muscular imprints are not preserved in the mould.

From the cretaceous limestone bed at Maria Farinha, Prov. of Pernambuco, Brazil. Only two specimens have been obtained.

Family CARDIADÆ.

***Cardium Soaresanum* sp. nov.**

Shell small, gibbous, subquadrangular in outline, and with the antero-posterior and vertical diameters nearly equal. The depth of the two valves equals about two-thirds or three-fourths the antero-posterior diameter. The hinge is nearly as long as the shell, and rounds very rapidly into both the anterior and posterior margins, the

latter of which is often nearly straight and about at right angles to the hinge. The anterior and ventral margins together form a single, quite regular curve, uniting somewhat abruptly with the posterior margin.

Beaks small, acute in the interior moulds, strongly incurving and inclining moderately forward. Their apices are situated a little anterior to the middle and are approximate. Valves most convex just above the centre, and arching rather strongly from the ventral margin to the beaks. The most prominent line of curvature of the shell passes obliquely downward and backward from the beak toward the lower posterior angle, sometimes not far posterior to the middle, at others about one-third the length from the posterior margin, thus giving to the shell a slightly oblique appearance. The curvature across the valves, from the anterior to the posterior margin, is very strong and always more abrupt posteriorly. Sometimes the posterior slope is nearly straight, and the valves are then slightly angular along the most prominent line of curvature.

The shell is marked with prominent radiating plications only, about twenty to twenty-five in number on each valve. I have not been able to detect any concentric lines. On the middle and larger portion of the valves the plications are rather broad and flattened, and separated by narrow, shallow, rounded depressions, sometimes scarcely more than striae. Toward the anterior and posterior extremities the plications become regularly rounded and gradually narrower. At the same time the interspaces, which are also rounded, increase in size and near the margin exceed the plications in width. From the anterior seven or eight plications arise minute spines, having rounded or elongate bases and arranged in single rows. The plications nearest the margin have six or eight spines, but these decrease in number toward the middle, and become limited to the lower part of the plications, the last two or three having but a single spine each, and that near the ventral margin. The posterior ribs were probably also spinous. Length of a large specimen, 20 mm.; height, 20 mm.; depth, 14 mm.

This Brazilian species of *Cardium* resembles very much in shape *Cardium speciosum*, M. and H. from the cretaceous at the mouth of the Judith river, upper Missouri, but in ornamentation the two differ. In *C. speciosum* the costæ are narrower and the spines much more numerous. I have not seen the interior of the latter species.

From the cretaceous beds at São José and Pt. Nova Cruz, Prov.

of Pernambuco, Brazil. At the former locality it is very abundant, both as interior and exterior moulds.

Dedicated, at Mr. Derby's request, to Sr. Fredrico Marques de Costa Soares, whose hospitality and efficient aid rendered possible the examination of the localities.

Family VENERIDÆ.

Callista McGrathiana sp. nov.

Shell small, elongate, and with the valves moderately convex; length somewhat greater than the height; outline subelliptical.

The beaks are situated a little in advance of the middle, are prominent and incline rather strongly forward. Their internal moulds are sharply pointed and incurve slightly. The hinge margin descends quite rapidly from the beaks posteriorly, and is moderately curved, nearly the same curve being continued in the larger part of the posterior margin, while the ventral margin is also very regularly, but more gradually, rounded.

The point of greatest convexity of the valves is just above the middle, though the curvature of the surface from the beaks to the ventral margin is usually quite regular. The curvature along the antero-posterior diameter is moderate and more or less regular. The slope toward the posterior and hinge margins is usually quite rapid, and increases in strength near the beaks; it is always well rounded.

The surface of the shell is marked with numerous small, rounded, concentric raised-lines, separated by similar interspaces of slightly greater width. They are quite equally disposed, sometimes, however, differing in width and placed nearer together. They round up strongly in front.

The muscular imprints are of moderate size, slightly excavated, and are situated just above the antero-posterior axis. Of the cardinal teeth, the anterior is nearly perpendicular, bending slightly forward below, while the posterior, which is the longer, extends backward, bending a little downward. The dental prominence in front of the cardinal teeth is somewhat elevated.

This small form, not represented by any perfect impression of the exterior, seems to be a true *Callista*, as indicated by shape and hinge-markings. Size: length, 14 mm.; height, 11 mm.; depth of two valves, 6 mm.

Moderately abundant in the cretaceous beds at Pt. Nova Cruz and São José, Prov. of Pernambuco, Brazil. Respectfully dedicated to Dr. McGrath of Pernambuco, to whom Prof. Hartt and his party are indebted for many favors and valuable information regarding the geology of the vicinity of Pernambuco.

Family TELLINIDÆ.

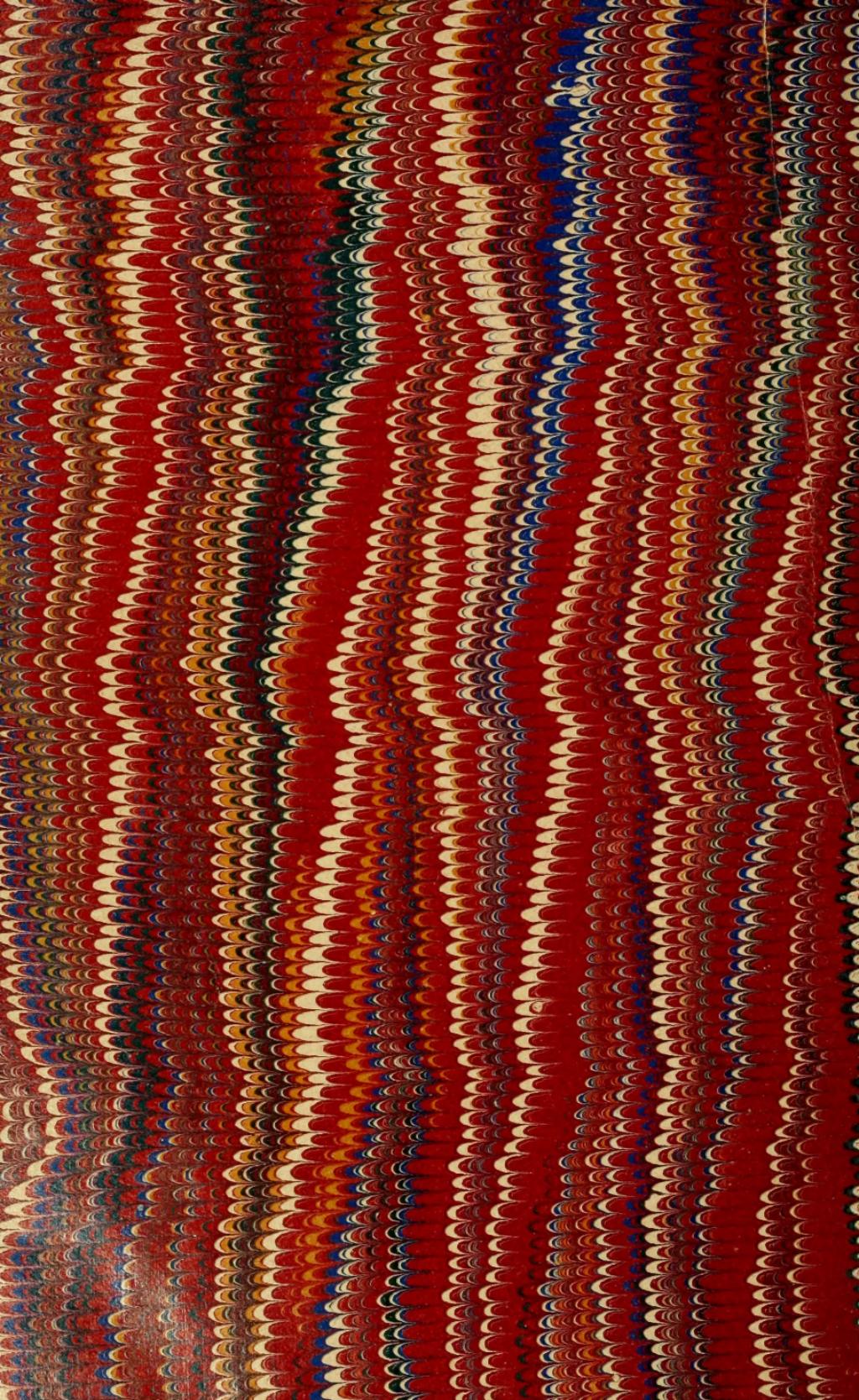
Tellina pernambucensis sp. nov.

Shell small, compressed, elongate, with the length equal to about one and one-half times the height. Outline longitudinally sub-ovate.

The beaks are situated near the middle, and are minute, pointed and scarcely elevated above the hinge. In front of the beaks the hinge margin descends gradually, curving very slightly toward the anterior margin, which is regularly rounded. Posterior to the beaks the hinge is nearly straight and descends a little more rapidly than in front. The posterior extremity is not quite so high as the anterior, but is quite regularly rounded. The ventral margin curves moderately and regularly.

The valves are depressed-convex, being most prominent anteriorly and just above the antero-posterior axis. The curvature of the shell from the ventral margin to the beaks is very gradual, and increases slightly in strength upward. The surface rises gradually from the anterior margin, curves slightly for one-third the length or more, and then generally descends very gradually to the posterior extremity, in a nearly straight slope. Hence the shell is usually very much compressed posteriorly. Sometimes, however, it is not at all flattened, but nearly equally convex throughout. The surface is marked with very minute, regular, rounded, concentric raised lines, set closely together. The impressions of the muscular markings have not remained on the internal moulds. The imprints of the two minute cardinal teeth are very distinct in one specimen. Length, 17 mm.; height, 12 mm.; depth of each valve, about 2.5 mm.

From the cretaceous beds at Pt. Nova Cruz and São José, Prov. of Pernambuco, Brazil, where only a few specimens have been found.





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